THE EFFECT OF CONNECTIVITY FOR FRACTURED ROCKS ON FLUID FLOW THROUGH FRACTURES*

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The movement of fluid flow in rocks fracture networks is a relatively intricate problem. Mutual incision fractures make channels of fluid flow movement. Since fractured incision is of random, some channels, such as large scale fractures and faults etc., can run through the whole research regions. Others make 'dead' channels because of no hydraulic relationships among fractures. The phenomena can be described by effective connectivity of fracture networks. At the same time, on account of the effect of fillings or external stress, some parts of individual fracture may be closed, which has the great effect on fluid flow through fractures. The phenomena relates to single fracture connectivity. Therefore, permeability of fractured rocks not only depends on the transmissivity of single fracture, but also degree or probability of fracture networks connection. However, modeled fluid flow of fracture networks, present literatures (C. Cacas, E. Ledoux, G. de Marsily, and B. Tillie 1990; Wan Li, Li Dingfang, Li Jiqing 1993) often regard fracture apertures as constant. Some consider the effect of fracture variable apertures (A. Wille nordqvist, and Y. W. Tsang, etc. 1992), roughness (SHEMIN GE 1997) and tortuosity (Y. W. Tsang 1984; Yang Mijia, CHENG Mingxiong, and He Yongnian 2001), but the factor of connectivity for single fracture is generally ignored.

The distribution forms of many fractures, however, are of random and indetermination, so one should use valid methods to understand hydraulic characteristics of individual and network fracture well. Mathematics statistics is one of effective methods in solving these problems. Based on statistics of fracture geometries, including orientation, span, length and aperture, the distribution of fracture geometries can be determined. At last, fracture networks are random generated by Monte-Carlo method. Thereby, fluid flow characteristics of fractured rocks can be studied through fracture networks analysis.

In the paper, the conception of connectivity for fractured rocks is discussed carefully based on percolation theory. Simultaneously, analytical expression of calculating connectivity is developed. Furthermore, on the basis of statistic characteristics of fracture geometries, fracture networks are random generated by Monte-Carlo method. Combined numerical method with analytical expression of connectivity, fluid flow characteristics of fracture networks is modeled. Example shows fractured connectivity has very important effect on the fluid flow through fractured rock mass.

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